Human Health & Well-Being: Green Infrastructure, Co-Design, Co-Benefits

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Outline

Health & Nature: the evidence

Key Studies
City Trees

Green Stormwater Infrastructure, Human Health

Economic Value
Percentage of population living in urban areas: 73.8%
Population proportion between ages 30 and 70 years: 52.9%

Proportional mortality (% of total deaths, all ages, both sexes)

- Cardiovascular diseases: 60%
- Cancers: 16%
- Chronic respiratory diseases: 2%
- Diabetes: 0%
- Other NCDs: 8%
- Injuries: 8%
- Communicable, maternal, perinatal and nutritional conditions: 6%

Total deaths: 2,102,000
NCDs are estimated to account for 86% of total deaths.
World Health Organization

Health Definition

A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (1946)
Social Determinants of Health

Dahlgren and Whitehead 1991
Green Cities: Good Health
www.greenhealth.washington.edu

Sponsors:
USDA Forest Service,
(U&CF Program + Pacific NW Research)
University of Washington
NGO partners

Thanks!
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Research Reviews & Summaries
Local Economics

Trees in cities are not grown and managed for products that can be bought and sold on markets, but they do provide many intangible services and functions! This article serves two purposes. First, it introduces valuation methods that are used to convert intangible benefits to dollar sums.\(^1\)\(^2\) Then, it shows how nonmarket valuations can support local decision-making.

Fast Facts

- The presence of larger trees in yards and as street trees can add from 3% to 15% to home values throughout neighborhoods.

- Averaging the market effect of street trees on all house values across Portland, Oregon yields a total value of $1.35 billion, potentially increasing annual property tax revenues $15.3 million.\(^9\)

- A study found 7% higher rental rates for commercial offices having high quality landscapes.\(^3\)\(^4\)

- Shoppers claim that they will spend 9% to 12% more for goods and services in central business districts having high quality tree canopy.\(^3\)\(^4\)

- Shoppers indicate that they will travel greater distance and a longer time to visit a district having high quality trees, and spend more time there once they arrive.\(^3\)\(^4\)
Lifecycle :: disease & illness

Cumulative U.S. DALYs for the Leading Disease/Disorder Categories by Age (2010)

Disability Adjusted Life Year

Data courtesy of WHO
Urban Forests and Newborns

the natural environment may affect pregnancy outcomes . . .

10% increase in tree-canopy cover within 50m of a house

= lower number of low weight births (1.42 per 1000 births)

Donovan et al., Health & Place 2011; Hystad et al., Env Health Perspectives 2014
EAB Tree Loss & Public Health

1990 to 2007, 1,296 counties in 15 states infected areas vs. no bugs
15,000 more deaths from cardiovascular disease
6,000 more deaths from lower respiratory disease
controlled for demographic, human mortality, and forest health data at the county level

Toledo, Ohio in 2006, pre EAB

2009, EAB in neighborhood

photo credits: Dan Herms, Ohio State U
Canopy Cover & Stress

images of canopy cover varied 0-60%

Improving Depression

20 adults with major depression walk in a park setting and an urban setting

- 50-minute walks one week apart
- before-after testing:
  - Mood: Positive and Negative Affect (PANAS)
  - Cognition: Backward Digit Span (BDS)

Berman et al. 2012. Journal of Affective Disorders

cognitive and affective improvements after walking in a nature setting
Shinrin yoku (forest bathing)

• extensive research
• restorative experiences
• workers retirees
• networked system, 52 bases in Japan
Outside Our Doors
The benefits of cities where people and nature thrive.
Outline

Health & Nature: the evidence

Urban Forest Key Studies

Green Stormwater Infrastructure, Human Health

Economic Value
Reducing Stormwater Runoff

credit: Center for Urban Forest Research. US Forest Service
Stormwater Management

Thornton Creek Water Quality Channel (Seattle, SvR Design)
1 hectare, treats runoff from 275 hectares (1 hectare = 2.47 acres)
Atlanta, Georgia
Historic Fourth Ward, Atlanta

Clear Creek Basin, 2 acre stormwater detention lake, 17 acres of greenspace & parks amenities
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Key Studies

Green Stormwater
Infrastructure, Human Health

Economic Value
Story: Human Health Benefits Across the Life Cycle
KATHLEEN L. WOLF, PH.D.

also in Spanish! and Arabic!

design: milepost

author: Forest Service

printing: The Nature Conservancy
Nearby nature experiences are important across the entire life cycle, from cradle to grave.

Research about nature benefits and economic value is fairly new. Some of the quantified health benefits of nature in cities are easier to convert to economic value than others. Here are some preliminary valuations - estimated for the entire U.S. on an annual basis.

**INFANTS**

**BIRTH WEIGHT**

**ECONOMIC BENEFIT**

*Potential Economic Value: $6.605B Savings on Annual Health Care Costs*

Birth weight influences long-term childhood health and development, and has been linked to some serious diseases. Low birth weight, associated with both short- and long-term health costs, such as longer hospital stays and increased illness. Pregnant women who have more trees in their yards and green space near their homes generally have babies with healthier birth weights.

**IMMUNE FUNCTION**

*Stress triggers the release of hormones that can impair the immune system.*

We are most vulnerable in the early months of life, when the body and mind are growing and developing at an astonishing rate. The "biodiversity hypothesis" suggests that early contact with outdoor environments attenuates the development of a healthy immune system.

**FAMILY DYNAMICS**

*Improved family dynamics, perhaps reducing mental health treatment and counseling services.*

An infant's parents and siblings adjust their lives after a baby arrives, and the changes can bring on stress and anxiety. Nature views and walks help reduce stress and improve interactions between people within the household.

Note: All economic values are in 2010 U.S. dollars, and are potential annual savings across the entire U.S.

**CHILDREN & TEENS**

**OVERALL HEALTH AND WELL-BEING**

**ECONOMIC BENEFIT**

*Increased physical activity, reduced asthma, reduced cause of emergency department visits, hospitalizations, and missed school days, and reduced risk of adult skin conditions.*

Engaging in nature helps children develop learning, social, and intellectual skills that improve both health and later life achievement. Green spaces close to their homes and towns help give these spaces a more moderate, active, and shadie from 20 to 30 minutes of walking, nature's symptoms.

**ADHD**

*Potential Economic Value: $12.063B Savings on Medication Savings per Year*

Millions of children ages 0-19 are treated for Attention Deficit Hyperactivity Disorder (ADHD) in the U.S. Nature exposure in a potential alternative treatment, studies show that activity within nature or green spaces, such as play, or even 30 minutes of walking, nature's symptoms.

**CARDIOVASCULAR DISEASE**

*Potential Economic Value: $13.3-16.3B Annual Savings, based on a 1.7-4.1% reduction in hospital expenditures.*

Cardiovascular Disease is the leading cause of premature death in the U.S. People are shown to be at risk of heart disease who have negative experiences in nature or green spaces, such as playing or relaxing.

**ADOLESCENTS**

*Increased mental health and function.*

**ADULTS**

**DEPRESSION AND STRESS**

**ECONOMIC BENEFIT**

*Reduced frustration, mental distress and depression disorders, and improved body image, self-esteem, and life satisfaction.*

Most highly scheduled lifestyles take their toll. Nature experiences reduce stress. Nearly 100 million adults experience major depression each year in the U.S., and could benefit from nature experiences that improve mental health and function. Improved mental health and function reduce disease treatment costs, and improve work productivity.

**MOBILITY & QUALITY OF LIFE**

*Potential Economic Value: $1.7-9.4B Savings on Health Care Costs from Falls Per Year.*

One in four adults falls each year, giving rise to fatal and serious injuries. Naturally safe environments are particularly important for mobility. Being active in nature maintains physical, mental, and social connections. Nature experiences help reduce the risk of falls and can reduce need for medications. Furthermore, those who are socially isolated are more likely to have an injury, so nature and walking activities that promote social interactions support a good quality of life.

**OLDER ADULTS**

**HYPERTENSION**

*Potential Economic Value: $1.2-3.6B Annual Savings on Treatment Costs Annually.*

Hypertension, or high blood pressure, is one of the five most expensive conditions impacting older adults. View of nature, particularly forests, and "forest bathing" (walking in natural forest settings) decrease blood pressure.

**COGNITIVE DISORDERS**

*Potential Economic Value: $1.2-3.6B Annual Savings on Medical Services, Not Counting the Value of Home Caregivers’ Services.*

About one in five older adults experiences limited cognitive function, with age being the greatest risk factor. In 2014, about 11% of people aged 85 or older were affected by Alzheimer’s disease. Those with dementia have three times as many hospital stays per year as other elders. Encounters with nature improve symptoms related to cognitive disorders, such as agitation, depression, and reduced mobility.

**contributing analysts:**

Dr. Stephen Grado & Marcus Measells, MSU; Dr. Alicia Robbins, Weyerhaueser
annual value of $11.7 billion
U.S. (2015 dollars)

• cradle to grave human life cycle
• varied expressions of urban greening (metro nature)
• evidence based human health & wellness benefits (ADHD, cardiovascular, Alzheimers)
• first efforts! new analysis in the works (supported by U.S. Tree Fund)
Summary: Science to Practice

• nature in cities & human health
• ~ 40 years of research, > 5K publications
• green infrastructure, trees, water
• co-design for co-benefits
Green Infrastructure Settings

Nearby nature includes a variety of spaces and places:

- **Urban Forest Canopy**
- **Biophilic Design**
- **Parks and Gardens**
- **Green Stormwater Infrastructure**
SYSTEMS THINKING

- AIR QUALITY
- STORMWATER
- ENERGY
- COMMUNITY IDENTITY
- SOCIAL CAPITAL
- ACTIVE MOBILITY
- EXERCISE & FITNESS
- BIOTA
- CARBON
- BMP'S
- PUBLIC ART
- CULTURAL HERITAGE
- CONNECTIVITY
- WASTE WATER
- SOLID WASTE
- HEAT ISLAND
- ALLERGENS

credit: American Planning Association
So the tree rustles in the evening,

Trees have long thoughts, long-breathing and restful,

just as they have longer lives than ours.

Hermann Hesse, *Trees: Reflections and Poems*
Human Dimensions of Urban Forestry and Urban Greening

featuring research on peoples' perceptions and behaviors regarding nature in cities

What's New?
Nature and Consumer Environments
Research about how the urban forest influences business district visitors.

Trees and Transportation
Studies on the value of having quality landscapes in urban roadsides.

Civic Ecology
Studies of human behaviors and benefits when people are active in the environment.

Policy and Planning
Integrating urban greening science with community change.

Urban Forestry and Human Benefits
More resources, studies and links...

Green Cities: Good Health
human health & well-being research

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www.naturewithin.info